IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re PATENT application of:

Applicant(s):	Eisenberg et al.
Serial No:	10/039,128
Filed:	January 7, 2002
Title:	MULTI-MODALITY APPARATUS FOR DYNAMIC ANATOMICAL PHYSIOLOGICAL AND MOLECULAR IMAGING
Examiner:	Baisakhi Roy
Art Unit:	3737
Docket No.	MULDP0101US

APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The undersigned submits this brief for the Board's consideration of the appeal of the Examiner's decision, mailed February 5, 2008, finally rejecting claims 1, 9-11, 14-16 and 25-51 of the above-identified application. A payment by credit card covering the fee for filing this brief is included.

I. Real Party in Interest

The real party in interest in the present appeal is Multi-Dimensional Imaging, Inc., the assignee of the present application.

II. Related Appeals and Interferences

Neither appellant, appellant's legal representative, nor the assignee of the present application are aware of any appeals or interferences, which will directly affect, which will be directly affected by, or which will have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1-17 and 19-51 are pending. Claims 2-8, 12, 13, 17 and 19-24 have been withdrawn from consideration. Claims 1, 9-11, 14-16 and 25-51 stand finally rejected and are the subject of this appeal. A correct copy of these claims is reproduced in the Claims Appendix.

IV. Status of Amendments

No amendments have been filed after the final rejection of claims 1, 9-11, 14-16 and 25-51, which was mailed on February 5, 2008.

V. Summary of Claimed Subject Matter[1]

The claimed subject matter relates generally to an imaging system having one or more x-ray sources and detector arrays rotatable with respect to a gantry. At least one of the x-ray sources is configured to modulate x-rays produced by the x-ray source to assign a signal to the x-rays produced by the respective modulated x-ray source, and the collection system is configured to use the signal to demodulate data from the detector array. The claimed x-ray modulation and demodulation allows for separation of data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source. [p. 10, ln. 10 - p. 11, ln 21, p. 28, ln. 3 - p. 29, ln. 2; FIG. 3, FIG. 21, FIG. 22].

The Invention as Defined in the Rejected Claims

Claim 1 - An imaging system comprises at least one gantry 20; a table 22 for supporting and positioning a patient relative to said at least one gantry; at least one x-ray source 24 rotatable with respect to said at least one gantry 20 and to said table 22; at least one detector array 26 positioned to detect x-rays produced by said at least one x-ray source 24; a collection system 60 to acquire data received by said at least one detector array 26; and a reconstruction system 62 to process data acquired by said collection system; and wherein said at least one x-ray source 24 is modulated 160 for

[1] This summary is presented in compliance with the requirements of 37 C.F.R. §41.37(c)(1)(v), mandating a concise explanation involved in the appeal. Nothing contained in this summary is intended to change the specific language of the claims described, nor is the language in the summary to be construed so as to limit the scope of the claims in any way.

assigning a signal to the x-rays produced by the respective modulated x-ray source, and the signal is used to demodulate 166 data from the detector array 26 thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source (x-ray #2, x-ray #3).[p. 10, ln. 10 - p. 11, ln 21, p. 28, ln. 3 - p. 29, ln. 2; FIG. 3, FIG. 21, FIG. 22].

Claim 9 - The imaging system as defined in claim 1 further including a scatter rejection device 92 operatively connected to said configuration of focused two-dimensional curved detector arrays 26, said scatter rejection device 92 operable to reject those x-rays produced by said at least one x-ray source 24 that have been scattered outside a pre-determined area. [p. 25, ln. 27 - p. 27, ln. 9; FIG. 19].

Claim 14 - The imaging system as defined in claim 1, wherein said at least one detector array 26 includes a configuration of focused two-dimensional curved detector arrays, and wherein said configuration of focused two-dimensional curved detector arrays is positioned to minimize spatial resolution reduction from a central axis to the maximal axis regions of a pre-determined area, and wherein said at least one x-ray source 24 has an anode with a surface having at least one V-shaped groove therein to produce at least one focal spot and wherein the resulting images are comprised of pixel elements, each of said pixel elements being of a substantially constant radius and optimally focused toward its respective x-ray source focal spots, said x-ray focal spots being generated by said at least one x-ray source to achieve resolution in said pre-determined area. [p. 5, ln. 13-29, p. 14, ln. 23 - p. 15, ln. 5; FIG. 2].

Claim 15 - The imaging system as defined in claim 14 further including apparatus to geometrically dither said at least one focal spot to improve sampling and spatial resolution of the resulting images. [p. 17, ln. 10-24; FIG. 7].

Claim 16 - The imaging system as defined in claim 14 further including apparatus to geometrically dither said configuration of focused two-dimensional curved detector arrays in the X and Z directions to improve sampling and spatial resolution of the resulting images. [p. 17, ln. 25 - p. 18, ln. 9; FIG. 7b].

Clam 49 - The imaging system as defined in claim 1, wherein the x-rays produced by said at least one x-ray source are modulated with a carrier frequency, and the carrier frequency is used to demodulate the data from the detector array. [p. 28, ln 3-19; FIG. 21].

Claim 50 - The imaging system as defined in claim 1, wherein the x-rays are amplitude modulated. [p. 28, ln. 20 - p. 29, ln. 2; FIG. 22].

Claim 51 - An imaging system that comprises at least one gantry 20; at least one x-ray source 24 rotatable with respect to the at least one gantry 20; at least one detector array 26 positioned to detect x-rays produced by the at least one x-ray source 24; a collection system 60 to acquire data received by said at least one detector array 26; and a reconstruction system 62 to process data acquired by said collection system 60; wherein the at least one x-ray source 24 is configured to modulate 160 x-rays produced by the at least one x-ray source 24 to assign a signal to the x-rays produced by the respective modulated x-ray source 24, and the collection system 60 is configured to use the signal to demodulate data166 from the detector array 26 thereby to separate

the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source (x-ray #2, x-ray #3). [p. 10, In. 10 - p. 11, In 21, p. 28, In. 3 - p. 29, In. 2; FIG. 3, FIG. 21, FIG. 22].

VI. Grounds of Rejection to Be Reviewed on Appeal

A. Claims 1, 9-11, 14-16 and 25-51 stand finally rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent. No. 7,180,074 (***Crosetto***).

VII. Argument[2]

The rejections advanced by the Examiner are improper and should be reversed for at least the following reasons.

A. Rejection of claims 1, 9-11, 14-16 and 25-51 under 35 U.S.C. § 102(e)

Claims 1, 9-11, 14-16 and 25-51 stand finally rejected as being anticipated by ***Crosetto***. For the reasons discussed below, this rejection should be reversed.

In general, the anticipation rejections of claims 1, 9-11, 14-16 and 25-51 describe and/or discuss aspects of ***Crosetto*** without applying ***Crosetto*** to the elements recited in the various claims. In fact, many of the features recited in the rejected claims are not mentioned in the final rejections. For at least this reason, the rejections are improper and should be reversed.

Claims 1, 10, 11 and 25-48

Claim 1 recites an imaging system that includes, *inter alia*, at least one x-ray source rotatable with respect to a gantry and a table, wherein the at least one **x-ray source is modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source**, and **the signal is used to demodulate data**

[2] In the event the Examiner clarifies the rejections of any claims that have not been argued separately, Applicant reserves the right to argue separately such claims.

<u>from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source</u>.

For convenient reference, the text of the final rejection of claims 1, 9-11, 14-16 and 25-51 is provided below.[3]

> Claims 1, 9-11,14-16, and 25-51 are rejected under 35 U.S.C. 102(e) as being anticipated by Crosetto (7180074). Crosetto discloses an imaging system including a gantry, a patient support table, an x-ray source rotatable with respect to the gantry and the table, a detector array positioned to detect x-rays produced by the x-ray source, a collection system to acquire data received by the detector array, and a reconstruction system to process data acquired by the collection system (col. 23 lines 51 - col. 24 lines 7) , where the system is capable of operating in VCT, DR, PET and NM/SPECT modes of operation (col. 33 lines 22- col. 34). The system includes a scatter rejection device operatively connected to the configuration of the focused two-dimensional curved detector arrays and operable to reject those x-ray produced by the x-ray source or collimate single photon gamma rays when the system is in a NM/SPECT mode of operation, where said collimation device is operable to improve the spatial resolution, sensitivity and energy range of single photon gamma rays when the system is in a NM/SPECT mode of operation (col. 37 lines 11-27 lines 41-54, col. 61 lines 10-44).
>
> The configuration of the two-dimensional curved detector arrays is positioned to minimize spatial resolution reduction from a central axis to the maximal axis regions of a pre-determined area (col. 50 lines 27-35). The reconstruction system uses data received by the collection system to reconstruct images from a helical volume spiral acquisition mode to produce whole body x-ray VCT volume images, where the reconstruction system selects data for helical spiral reconstructions, processing imaging data while utilizing redundant data (col. 38 lines 52-col. 39 line 4).
>
> The imaging system includes an adaptive x-ray dose control system using data received by the collection system to optimize patient dosage and desired image quality and permit adaptive real-time dosage control during the image scanning process (col. 48 lines 42 - col. 49 lines 52). The imaging system permits continuous updating of the volume imaging data in real-time on interactive displays and includes in interventional image control system to control the acquisition of data by the collection system permitting production of substantially real-time images of invasive procedures on the patient (col. 42 lines 1-50).
>
> The imaging system includes PET time stamping coincidence system for high

[3] The quoted final rejection text appears to track the language of of the rejection presented in the non-final Office Action, mailed August 22, 2007 verbatim.

count rate PET imaging, said PET time stamping coincidence system providing optimal coincidence digital time stamping of a positron generated gamma rays for real time randoms correction derived from average count rate adjustment and delay coincidence window rate (col. 60 lines 11-54). The imaging system includes a transmission attenuation system for whole body transmission attenuation correction, said attenuation system generating image projection corrections using VCT image and attenuation data. (col. 37 lines 11-27, col. 38 lines 14-17, col. 61 lines 26 - col. 62 lines 52).

The imaging system includes a detector array which includes a configuration of focused two-dimensional curved detector arrays, wherein at least one gantry is comprised of a first gantry, a second gantry and a third gantry, said first, second, and third gantries being operatively attached to one another, where the configuration of focused two-dimensional curved detector arrays is comprised of a first configuration of focused two-dimensional curved detector arrays positioned to detect x-rays when the system is in VCT and DR modes of operation, a second configuration of focused two-dimensional curved detector arrays positioned to detect coincident gamma rays when the system is in PET mode of operation, and a third configuration of two-dimensional curved detector arrays positioned to detect gamma rays when the system is in a NM/SPECT mode of operation (col. 35 lines 52 - col. 38 line 50).

As can be seen, the above-quoted rejection does not address the claim recitation of at least one x-ray source modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source, and the signal used to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source.

In reply to the non-final Office Action, mailed August 22, 2007, the applicant pointed out that the rejection of claim 1 failed to address the claim recitation of at least one x-ray source modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source, and the signal used to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source. In response to

applicant's arguments, the Examiner provided the following response in the final Office Action, mailed February 5, 2008.

> Applicant's arguments filed 11/20/07 have been fully considered but they are not persuasive. Crosetto teaches a multimodality imaging device which provides anatomical and physiological information in a single image without having to go through several examinations. With respect to scatter correction, Crosetto teaches a scatter rejection device operatively connected to the configuration of the focused two-dimensional curved detector arrays and operable to reject those x-ray produced by the x-ray source or collimate single photon gamma rays when the system is in a NM/SPECT mode of operation, where said collimation device is operable to improve the spatial resolution, sensitivity and energy range of single photon gamma rays when the system is in a NM/SPECT mode of operation (col. 37 lines 11-27 lines 41-54, col. 61 lines 10-44). ***Therefore*** the x-ray source can be modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source and the signal is used to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source. The previous rejection is maintained and repeated below. (Emphasis added).

In responding to applicant's arguments, filed November 20, 2007, the Examiner further discusses ***Crosetto*** without applying ***Crosetto*** to claim 1, and simply makes a conclusory statement that "the x-ray source can be modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source and the signal is used to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source" without any reference to ***Crosetto*** or support for the assertion. It is not seen how the Examiner's assertion after "Therefore" can possibly follow from the Examiner's discussion preceding the conclusory statement. For at least this reason, the rejection of claim 1 is improper and should be removed.

Further, ***Crosetto*** has not been found to disclose the claimed imaging system having a x-ray source that is modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source, and the signal is used to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source. In fact, the term modulate (or a variation thereof) has not been found in ***Crosetto*** at all, let alone, the claimed imaging system having a x-ray source that is modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source, and the signal is used to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source.

For at least these reasons, the anticipation rejection of claim 1 cannot be maintained because it is unsupported by ***Crosetto***.

Claim 9

Claim 9 is dependent on claim 1, therefore, the arguments presented above with respect to the deficiencies of ***Crosetto*** in relation to claim 1 are equally applicable to claim 9. For at least this reason, the rejection of claim 9 is improper.

In addition claim 9 recites the imaging system as defined in claim 1 further including a scatter rejection device operatively connected to said configuration of focused two-dimensional curved detector arrays, said scatter rejection device operable

to reject those x-rays produced by said at least one x-ray source that have been scattered outside a pre-determined area.

Crosetto has not been found to disclose, in a manner like that recited in claim 9, an x-ray source that is modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source and/or using the assigned signal to demodulate data from the detector array to separate data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source in combination with a scatter rejection device operatively connected to said configuration of focused two-dimensional curved detector arrays, said scatter rejection device operable to reject those x-rays produced by said at least one x-ray source that have been scattered outside a pre-determined area. Therefore, the rejection of claim 9 is unsupported by ***Crosetto***, and should be removed.

Claim 14

Claim 14 is dependent on claim 1, therefore, the arguments presented above with respect to the deficiencies of ***Crosetto*** in relation to claim 1 are equally applicable to claim 14. For at least this reason, the rejection of claim 14 is improper.

In addition, claim 14 recites the imaging system as defined in claim 1, wherein said at least one detector array includes a configuration of focused two-dimensional curved detector arrays, and wherein said configuration of focused two-dimensional curved detector arrays is positioned to minimize spatial resolution reduction from a central axis to the maximal axis regions of a pre-determined area, and wherein said at

least one x-ray source has an anode with a surface having at least one V-shaped groove therein to produce at least one focal spot and wherein the resulting images are comprised of pixel elements, each of said pixel elements being of a substantially constant radius and optimally focused toward its respective x-ray source focal spots, said x-ray focal spots being generated by said at least one x-ray source to achieve resolution in said pre-determined area.

The final rejection does not address claim 14. Therefore, the rejection is improper and should be removed.

Claim 15

Claim 15 is dependent on claim 1 and claim 14, therefore, the arguments presented above with respect to the deficiencies of ***Crosetto*** in relation to claim 1 and claim 14 are equally applicable to claim 15. For at least this reason, the rejection of claim 15 is improper.

In addition, claim 15 recites the imaging system as defined in claim 14 further including apparatus to geometrically dither said at least one focal spot to improve sampling and spatial resolution of the resulting images.

The final rejection does not address claim 15. Therefore, the rejection is improper and should be removed.

Claim 16

Claim 16 is dependent on claim 1 and claim 14, therefore, the arguments presented above with respect to the deficiencies of ***Crosetto*** in relation to claim 1 and claim 14 are equally applicable to claim 16. For at least this reason, the rejection of claim 16 is improper.

In addition, claim 16 recites the imaging system as defined in claim 14 further including apparatus to geometrically dither said configuration of focused two-dimensional curved detector arrays in the X and Z directions to improve sampling and spatial resolution of the resulting images.

The final rejection does not address claim 16. Therefore, the rejection is improper and should be removed.

Claim 49

Claim 49 is dependent on claim 1, therefore, the arguments presented above with respect to the deficiencies of ***Crosetto*** in relation to claim 1 are equally applicable to claim 49. For at least this reason, the rejection of claim 49 is improper.

In addition, claim 49 recites an imaging system as defined in claim 1, wherein the x-rays produced by said at least one x-ray source are modulated with a carrier frequency, and the carrier frequency is used to demodulate the data from the detector array. The final Office Action does not address the claimed modulation with a carrier frequency, and the carrier frequency being used to demodulate the data from the detector array. For at least this reason, the rejection is improper.

In addition, ***Crosetto*** has not been found to disclose the claimed imaging system including at least one x-ray source modulated with a carrier frequency, and the carrier frequency is used to demodulate the data from the detector array thereby to separate the data arising from detection of the amplitude modulated x-rays from data arising from scatter from another x-ray source. As such, ***Crosetto*** does not support the rejection. Therefore, the rejection of claim 49 is improper should be removed.

Claim 50

Claim 50 is dependent on claim 1, therefore, the arguments presented above with respect to the deficiencies of ***Crosetto*** in relation to claim 1 are equally applicable to claim 50. For at least this reason, the rejection of claim 50 is improper.

In addition, claim 50 recites an imaging system as defined in claim 1, wherein the x-rays are amplitude modulated. The final Office Action does not the claimed amplitude modulation of an x-ray source. For at least this reason, the rejection is improper.

In addition, ***Crosetto*** has not been found to disclose the claimed imaging system including at least one x-ray source that is amplitude modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source and the signal being used to demodulate data from the detector array thereby to separate the data arising from detection of the amplitude modulated x-rays from data arising from scatter from another x-ray source. As such, ***Crosetto*** does not support the rejection. Therefore, the rejection of claim 50 is improper should be removed.

Claim 51

The above remarks respecting claim 1 are equally applicable to claim 51.

Claim 51 recites an imaging system that includes, *inter alia*, at least one x-ray source **configured to modulate x-rays produced by the at least one x-ray source to assign a signal to the x-rays produced by the respective modulated x-ray source**, and a **collection system configured to use the signal to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source**.

As discussed above, with respect to claim 1, the Examiner's final rejection does not apply ***Crosetto*** to claim 51. Rather, the Examiner's final rejection discusses ***Crosetto*** generally, and then makes a conclusory statement that is unsupported by ***Crosetto***. For at least this reason, the rejection is improper and should be removed.

Also, as is discussed above with respect to claim 1, ***Crosetto*** has not been found to disclose or fairly suggest an imaging system having at least one x-ray source configured to modulate x-rays produced by the at least one x-ray source to assign a signal to the x-rays produced by the respective modulated x-ray source. In addition, ***Crosetto*** has not been found to disclose or fairly suggest a collection system configured to use the signal to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source.

For at least these reasons, the anticipation rejection of claim 51 cannot be maintained and should be reversed.

VIII. Conclusion

In view of the foregoing, it is respectfully submitted that the claims are patentable over the applied art and that the final rejection should be reversed.

This brief is being submitted along with a payment by credit card in the amount of $270.00 to cover the fee set forth in 37 CFR 41.20(b)(2).

Should a petition for an extension of time be necessary for the timely filing of this brief (or if such a petition has been made and an additional extension is necessary) petition is hereby made and the Commissioner is authorized to charge any fees to Deposit Account no. 18-0988, Order No. MULDP0101US.

Respectfully submitted,

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IX. Claims Appendix

Claims on Appeal

1. An imaging system comprising:

at least one gantry;

a table for supporting and positioning a patient relative to said at least one gantry;

at least one x-ray source rotatable with respect to said at least one gantry and to said table;

at least one detector array positioned to detect x-rays produced by said at least one x-ray source;

a collection system to acquire data received by said at least one detector array; and

a reconstruction system to process data acquired by said collection system; and

wherein said at least one x-ray source is modulated for assigning a signal to the x-rays produced by the respective modulated x-ray source, and the signal is used to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source.

9. The imaging system as defined in claim 1 further including a scatter rejection device operatively connected to said configuration of focused two-dimensional curved detector arrays, said scatter rejection device operable to reject those x-rays produced by said at least one x-ray source that have been scattered outside a pre-determined area.

10. The imaging system as defined in claim 1 further including a scatter correction device operatively connected to said configuration of focused two-dimensional curved detector arrays, said scatter correction device operable to collimate single photon gamma rays when the system is in a NM/SPECT mode of operation.

11. The imaging system and defined in claim 1 further including a collimation device interposed between the patient and said configuration of focused two-dimensional curved detector arrays, said collimation device operable to improve the spatial resolution, sensitivity and energy range of single photon gamma rays when the system is in a NM/SPECT mode of operation.

14. The imaging system as defined in claim 1, wherein said at least one detector array includes a configuration of focused two-dimensional curved detector arrays, and wherein said configuration of focused two-dimensional curved detector arrays is positioned to minimize spatial resolution reduction from a central axis to the

maximal axis regions of a pre-determined area, and wherein said at least one x-ray source has an anode with a surface having at least one V-shaped groove therein to produce at least one focal spot and wherein the resulting images are comprised of pixel elements, each of said pixel elements being of a substantially constant radius and optimally focused toward its respective x-ray source focal spots, said x-ray focal spots being generated by said at least one x-ray source to achieve resolution in said pre-determined area.

15. The imaging system as defined in claim 14 further including apparatus to geometrically dither said at least one focal spot to improve sampling and spatial resolution of the resulting images.

16. The imaging system as defined in claim 14 further including apparatus to geometrically dither said configuration of focused two-dimensional curved detector arrays in the X and Z directions to improve sampling and spatial resolution of the resulting images.

25. The imaging system as defined in claim 1 wherein said reconstruction system uses data received by said collection system to reconstruct images from a helical volume spiral acquisition mode to produce whole body x-ray VCT volume images, said reconstruction system selecting data for helical spiral reconstructions

while utilizing dose efficient angled cone-beam collimation, said reconstruction system processing imaging data while utilizing redundant data.

26. The imaging system as defined in claim 1 wherein said reconstruction system performs step and shoot VCT volume image reconstruction with isotropic spatial resolution.

27. The imaging system as defined in claim 26 wherein said step and shoot VCT volume image reconstruction utilizes traverse line projection data or spiral imaging data to fill in truncated view space so as to improve said volume image reconstructions.

28. The imaging system as defined in claim 1 further including an x-ray whole body planning system permitting the acquisition of images from a multiplicity of angles while traversing the whole body of a patient to produce single, bi-plane, or multi-plane whole body projection images which are utilized to plan subsequent multi-modality imaging procedures.

29. The imaging system as defined in claim 28 further including an adaptive x-ray dose control system using data received by said collection system to optimize patient dosage and desired image quality prospectively.

30. The imaging system as defined in claim 1 further including an adaptive x-ray dose control system using data received by said collection system to permit adaptive real-time dosage control during the image scanning process.

31. The imaging system as defined in claim 1 further including apparatus permitting the continuous updating of VCT volume imaging data in real-time on interactive displays and operator displays, said apparatus analyzing and processing imaging data in those regions where there have been view to view changes which exceed a predetermined level during the data acquisition process.

32. The imaging system as defined in claim 1 further including an interventional image control system utilizing VCT, DR, PET and NM/SPECT images to control the acquisition of data by said collection system permitting the production of substantially real-time images of invasive procedures on the patient.

33. The imaging system as defined in claim 32 wherein said interventional image control system includes an interventional planning system which allows the planning of interventional procedures and compares real-time actual interventional procedures with planned interventional procedures and corrects said actual interventional procedures to substantially coincide with said planned interventional procedures.

34. The imaging system as defined in claim 33 further including a minimally invasive robotic system to perform minimally invasive surgical procedures, said minimally invasive robotic system being operably controlled by said interventional planning system.

35. The imaging system as defined in claim 1 further including an image analysis system to perform dynamic anatomical, physiological and functional imaging display, fusion and analysis of VCT, DR, PET and NM/SPECT images.

36. The imaging system as defined in claim 1 wherein said configuration of focused two-dimensional curved detector arrays includes an independent channel processing system for achieving high imaging count rates when the system is in PET and NM/SPECT modes of operation.

37. The imaging system as defined in claim 36 further including a PET time stamping coincidence system for high count rate PET imaging, said PET time stamping coincidence system providing optimal coincidence digital time stamping of a positron generated gamma rays for real time randoms correction derived from average count rate adjustment and delay coincidence window rate.

38. The imaging system as defined in claim 1 further including a PET anti-scatter collimation ring interposed between the patient and said configuration of

focused two-dimensional curved detector arrays, said PET anti-scatter collimation ring comprising a set of baffles to reduce out-of-field scatter and to improve the coincidence rate.

39. The imaging system as defined in claim 1 further including a PET transmission attenuation system for whole body PET transmission attenuation correction, said PET transmission attenuation system generating image projection corrections using VCT image and attenuation data.

40. The imaging system as defined in claim 1 further including an NM/SPECT transmission attenuation system for whole body NM/SPECT transmission attenuation correction, said NM/SPECT transmission attenuation system generating image projection corrections using VCT image and attenuation data.

41. The imaging system as defined in claim 1 further including a PET transmission scatter fraction correction system for whole body PET three-dimensional scatter correction, said PET transmission scatter fraction correction system generating projection scatter corrections using VCT image and attenuation data.

42. The imaging system as defined in claim 1 further including an NM/SPECT transmission scatter fraction correction system for whole body NM/SPECT three-dimensional scatter correction, said NM/SPECT transmission scatter fraction

correction system generating projection scatter corrections using VCT image and attenuation data.

43. The imaging system as defined in claim 1 further including PET and NM/SPECT detector and imaging apparatus allowing multiple concurrent imaging for PET isotopes and NM/SPECT isotopes.

44. The imaging system as defined in claim 1 further including a shape compensation filter for attenuating cone beam x-ray radiation to minimize patient dosage and to normalize the dynamic range of said configuration of focused two-dimensional curved detector arrays.

45. The imaging system as defined in claim 1 further including a cone beam source collimator for spiral VCT imaging to reduce patient dosage and to substantially eliminate redundant imaging data.

46. The imaging system as defined in claim 1, wherein said at least one detector array includes a configuration of focused two-dimensional curved detector arrays, and wherein said at least one gantry is comprised of a first gantry, a second gantry and a third gantry, said first, second and third gantries being operatively attached to one another, and wherein said configuration of focused two-dimensional curved detector arrays is comprised of a first configuration of focused two-dimensional curved

detector arrays positioned to detect x-rays produced by said at least one x-ray source when the system is in VCT and DR modes of operation, a second configuration of focused two-dimensional curved detector arrays positioned to detect coincident gamma rays when the system is in a PET mode of operation, and a third configuration of focused two-dimensional curved detector arrays positioned to detect gamma rays when the system is in a NM/SPECT mode of operation, said table supporting and positioning a patient relative to said first, second and third gantries, said selecting means comprising means for controlling the relative lateral movement of said first, second and third gantries with respect to said table and the rotational movement of said at least one x-ray source and said first configuration of focused two-dimensional curved detector arrays with respect to said first gantry and to said table.

47. The imaging system as defined in claim 1, wherein said at least one detector array includes a configuration of focused two-dimensional curved detector arrays, and wherein said at least one gantry is comprised of a first gantry, a second gantry and a third gantry said first, second and third gantries being operatively attached to one another, and wherein said configuration of focused two-dimensional curved detector arrays is comprised of a first configuration of focussed two-dimensional curved detector arrays positioned to detect x-rays produced by said at least one x-ray source when the system is in VCT and DR modes of operation, a second configuration of focused two-dimensional curved detector arrays positioned to detect coincident gamma rays when the system is in a PET mode of operation, and a third configuration of

focused two-dimensional curved detector arrays positioned to detect gamma rays when the system is in a NM/SPECT mode of operation, said table supporting and positioning a patient relative to said first, second and third gantries, said selecting means comprising means for controlling the relative lateral movement of said first, second and third gantries with respect to said table and the rotational movement of said at least one x-ray source with respect to said first configuration of focused two-dimensional curved detector arrays, said first gantry and said table.

48. The imaging system as defined in claim 1, capable of operating in VCT, DR, PET and NM/SPECT modes of operation, further comprising means for selecting the mode of operation of said system, said selecting means comprising means for controlling the relative lateral movement between said at least one gantry and said table and the rotational movement of said at least one x-ray source with respect to said at least one gantry and to said table.

49. The imaging system as defined in claim 1, wherein the x-rays produced by said at least one x-ray source are modulated with a carrier frequency, and the carrier frequency is used to demodulate the data from the detector array.

50. The imaging system as defined in claim 1, wherein the x-rays are amplitude modulated.

51. An imaging system comprising:

at least one gantry;

at least one x-ray source rotatable with respect to the at least one gantry;

at least one detector array positioned to detect x-rays produced by the at least one x-ray source;

a collection system to acquire data received by said at least one detector array; and

a reconstruction system to process data acquired by said collection system;

wherein the at least one x-ray source is configured to modulate x-rays produced by the at least one x-ray source to assign a signal to the x-rays produced by the respective modulated x-ray source, and the collection system is configured to use the signal to demodulate data from the detector array thereby to separate the data arising from detection of the modulated x-rays from data arising from scatter from another x-ray source.

X. Evidence Appendix

None.

XI. Related Proceedings Appendix

None.